

इंटरनेट

मानक

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“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 7347 (1974): Performance of Small Size Spark Ignition Engines for agricultural sprayers and similar applications
[TED 2: Automotive Primemovers]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

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Indian Standard
SPECIFICATION FOR
PERFORMANCE OF SMALL SIZE SPARK IGNITION ENGINES

1. Scope — Covers the test procedure for naturally aspirated spark ignition engines up to 20 kW, generally used for industrial and agricultural purposes and also for motive power.

1.1 It excludes engines for road-going vehicles and those operating on gas or dual fuels.

2. Terminology — Following definitions shall apply.

2.1 Spark Ignition Engine — An engine in which ignition occurs by means of an electric spark.

2.2 Auxiliary — Items of equipment fitted to the engines which affect its declared power.

2.2.1 Dependent auxiliary — An item of equipment, presence of which affects the final output of the engine.

2.2.2 Independent auxiliary — An item of equipment, which uses power supplied from a source, other than engine.

2.2.3 Essential auxiliary — An item of equipment, which is essential for the continued or repeated use of the engine.

2.2.4 Non-essential auxiliary — An item of equipment, which is not essential for the continued or repeated use of the engine.

Note — Items of equipments fitted to the engine and without which the engine could not in any circumstances operate at its declared power are considered to be engine components and are not, therefore, classed as auxiliaries. Examples of typical auxiliaries are given in Appendix A for guidance only.

2.3 Speed — The speed of an engine is the mean speed of its crank shaft or the crank shafts in revolutions per minute (rpm).

2.4 Power — For the engines delivering power by shaft or shafts, any power in this standard is a quantity proportional to the mean torque calculated or measured, and to the mean speed of the shaft or shafts transmitting this torque. The power shall be declared in kilowatts; a kilowatt being the rate of doing work at one kilo joule per second.

2.4.1 Continuous power (rated power or continuous rating) — Power which the engine is capable of delivering continuously, between the normal maintenance intervals stated by the manufacturer, at rated speed and under standard reference conditions.

2.4.2 Indicated power — Total power developed in the working cylinder by the gases on the combustion side of the working pistons.

2.4.3 Brake power — The sum of the powers measured at the driving shaft or shafts.

2.5 Fuel Consumption — The quantity of fuel consumed by engine per unit of time at a stated power and under stated operating conditions. The quantity of liquid fuels should be expressed in mass units (kg).

2.5.1 Specific fuel consumption — Fuel consumption per unit of power, expressed in grams per kilowatt hour.

2.6 Full Throttle — Throttle opening corresponding to rated power.

3. Standard Reference Conditions — Standard reference conditions are:

- | | |
|-----------------------------|-----------------------------------|
| a) Mean barometric pressure | 100 kN/m ² (750 mm Hg) |
| b) Intake air temperature | 300 K (27°C) |

Note — Intake air temperature shall be measured at a distance of 150 mm from the air intake. If a filter is provided, the temperature shall be measured at a distance of 150 mm from the filter. Where air intake into the filter is from various directions, the mean of four readings taken from geometrically opposite points at equal distance shall be used. It shall be measured by a thermometer shielded from radiant heat.

Adopted 17 July 1974

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BUREAU OF INDIAN STANDARDS

MANAK BHAVAN, 9, BAHADUR SHAH ZAFAR MARG

NEW DELHI 110002

AMENDMENT NO. 3 SEPTEMBER 2011
TO
IS 7347 : 1974 SPECIFICATION FOR PERFORMANCE OF
SMALL SIZE SPARK IGNITION ENGINES FOR
AGRICULTURAL WATER PUMPS, SPRAYERS, TILLERS,
REAPERS AND OTHER SIMILAR APPLICATIONS

[Page 1, clause **1.1** (see also Amendments No. 1 and 2)] — Substitute the following for the existing:

‘**1.1** It covers spark ignition engines that start on petrol and subsequently run on kerosene or any other liquid fuel.’

(Page 5, clause **10.1**) — Substitute the following for the existing:

‘**10.1** The engine shall be marked with the following:

- a) Manufacturer’s name or trade-mark;
- b) Serial Number of the engine;
- c) Rated power;
- d) Rated speed; and
- e) Type of fuel used, for example, Petrol; Petrol start kerosene run or Petrol start diesel run.’

AMENDMENT NO. 2 OCTOBER 2008
TO
IS 7347 : 1974 SPECIFICATION FOR PERFORMANCE
OF SMALL SIZE SPARK IGNITION ENGINES FOR
AGRICULTURAL SPRAYERS AND SIMILAR
APPLICATIONS

[Page 1, Title (see also Amendment No. 1)] — Substitute the following for the existing title:

**'SPECIFICATION FOR PERFORMANCE OF SMALL SIZE SPARK
IGNITION ENGINES FOR AGRICULTURAL WATER PUMPS,
SPRAYERS, TILLERS, REAPERS AND OTHER SIMILAR
APPLICATIONS'**

[Page 1, clause 1 (see also Amendment No. 1)] — Substitute the following for the existing clause:

'1 SCOPE — Covers the performance requirements and test procedure for naturally aspirated spark ignition engines for agricultural water pumps, sprayers, tillers, reapers and other similar applications.'

[Page 1, clause 1.1 (see also Amendment No. 1)] — Substitute the following for the existing clause:

'1.1 It covers spark ignition engines that run on kerosene or petrol.'

(TED 2)

AMENDMENT NO. 1 JULY 1983
TO
IS : 7347-1974 SPECIFICATION FOR PERFORMANCE OF SMALL SIZE
SPARK IGNITION ENGINES

Alterations

(*Page 1, Title*) — Substitute the following for the existing title:

**' SPECIFICATION FOR PERFORMANCE OF SMALL SIZE SPARK IGNITION ENGINES
FOR AGRICULTURAL SPRAYERS AND SIMILAR APPLICATIONS '**

(*Page 1, clause 1*) — Substitute the following for the existing clause:

'1. Scope — Covers the test procedure and performance requirements for naturally aspirated spark ignition engines for agricultural sprayers and other similar applications. '

(*Page 1, clause 1.1*) -- Substitute the following for the existing clause:

' 1.1 It covers spark ignition engines that start on petrol and subsequently run on kerosene or any other liquid fuel. '

(*Page 3, clause 8.2.1*) — Substitute the following for the existing clause:

" 8.2.1 Fuel used shall be petrol, diesel oil or superior kerosene oil according to IS : 2796-1971 ' Specification for motor gasoline (*first revision*) ', IS : 1460-1974 ' Specification for diesel fuels (*second revision*) ', and IS : 1459-1974 ' Specification for kerosenes (*second revision*) ' respectively. The quantity or grade of lubricating oil shall be according to the manufacturer's recommendations."

(EDC 14)

c) Relative humidity	60 percent
d) Intake air depression and exhaust back pressure	Equal to that obtaining with intake and exhaust systems normally fitted to engine or recommended by manufacturer
e) Auxiliaries	Engine shall be equipped with all dependent essential auxiliaries as defined in 2.2.3

4. Declaration of Rated Power Output and Speed

4.1 Statement of power is required for two main purposes:

- Declaration by a manufacturer of the value of the power which the engine will deliver under standard reference conditions. This declared value is known as the 'rated power'.
- Verification by measurement that the engine delivers the power which has been declared in (a), under the standard reference conditions or after proper allowance has been made for any difference in conditions.

4.2 IS Rating — The power determined under the site conditions of the test bed and corrected to the standard reference conditions specified in 3 using power correction factor α (see 4.2.1) and is defined as the continuous net brake power.

4.2.1 Power correction factor ' α ' — It is the ratio of power output under the site conditions to the power output under standard reference conditions and is given by:

$$\alpha = k - 0.7 (1 - k) \left(\frac{1}{\eta} - 1 \right)$$

where

η = mechanical efficiency of the engine at rated load and speed and standard reference conditions (to be stated by the manufacturer). η should be taken as actual calculated value or 0.75 whichever is higher.

$$k = \frac{p_x - \phi_x p_{sx}}{100 - 0.60 p_{sr}} \left(\frac{300}{T_x} \right)^{0.5}$$

where

p_x = barometric pressure at site, kilonewtons per square metre;

ϕ_x = relative humidity at site, percent;

p_{sx} = saturated vapour pressure of water vapour corresponding to site temperature, kilonewtons per square metre;

p_{sr} = saturated vapour pressure of water vapour corresponding to standard reference temperature, kilonewtons per square metre; and

T_x = absolute air intake temperature at site, kelvin.

4.2.2 In deriving this factor, following assumptions have been made:

- The air fuel ratios are the same in both cases for equivalent engine performance.
- The indicated thermal efficiencies are the same.
- The frictional losses are the same.

4.3 Where the conditions of site are more favourable than the standard reference conditions specified in 3, the rating of the engine may be limited by the manufacturer to the declared power at the standard reference conditions specified in 3.

5. Declaration of Fuel Consumption

5.1 The engine manufacturer shall state the specific fuel consumption at rated output under the standard reference conditions specified in 3.

5.2 Unless otherwise agreed to between the manufacturer and the purchaser, the specific fuel consumption shall not exceed by more than 5 percent of that declared by the manufacturer.

5.3 The specific fuel consumption at the site conditions shall be corrected to the standard reference conditions using specific fuel consumption correction factor ' β ' (see 5.3.1).

5.3.1 Specific fuel consumption correction factor ' β ' is the ratio of the specific fuel consumption under site conditions to the specific fuel consumption under standard reference conditions, that is,

$$\beta = \frac{\text{Specific fuel consumption under site conditions}}{\text{Specific fuel consumption under standard reference conditions}}$$

$$\text{also } \beta = \frac{k}{\alpha}$$

Note — In deriving this factor, the assumptions made in 4.2.2 are valid.

6. Declaration of Lubricating Oil Consumption

6.1 The lubricating oil consumption is the quantity of lubricating oil consumed by an engine per unit of time. It should be expressed in litres per engine operating hour.

6.1.1 The lubricating oil consumption declared by the manufacturer shall be taken as maximum for the purpose of testing.

6.1.2 The oil discarded during an engine oil change should not be included in the declaration of lubricating oil consumption.

7. General Requirements for Tests

7.1 The manufacturer shall supply the performance characteristics of the engine prior to the commencement of tests. The performance characteristics shall consist of the following:

- a) Rated continuous brake output at rated speed and at standard reference conditions (in addition to continuous rating, maximum rating at a specific speed may also be given).
- b) Rated speed.
- c) Declared specific fuel consumption at rated output and rated speed.
- d) Declared lubricating oil consumption.

7.2 The engine offered for testing shall be from regular production line. All parts shall be in stock and all parts essential for engine operation shall be included. Auxiliaries used on the engine under test shall be listed.

8. Preparation for Tests

8.1 Strip Examination — The engine shall be dismantled for physical check of various components followed by dimensional inspection of the following:

- a) Cylinder and cylinder head.
- b) Valve gear.
- c) Piston assembly.
- d) Crank shaft journals and bearings.
- e) Connecting rod, including small-end and large-end bearings.
- f) Governor springs.

Note — In case of built-up assemblies involving press-fitting or shrink-fitting (for example, two crank shaft halves joined by press-fitted crank pin or ball bearings pressed on the shaft) the related parts need not be dismantled.

8.2 Reassembly — After the strip examination, the engine shall be reassembled by the manufacturer (or under the supervision of the manufacturer). Necessary adjustments shall be made according to the manufacturer's recommendations. The engine shall be mounted on suitable test bed.

8.2.1 Fuel used shall be normal commercial grade petrol. The quantity and grade of the lubricating oil shall be according to the manufacturer's recommendations.

8.3 Running-in — The engine shall be properly run-in before commencing the tests. Procedure of running-in shall be as recommended by the manufacturer. After running-in, all the adjustments should be checked and reset, if necessary.

8.3.1 During the running-in, the routine servicing and minor adjustments as required by the manufacturer's instruction manual shall be carried out.

8.4 Lubricating oil shall be changed and various filters cleaned as recommended by the manufacturer.

9. Test Procedure

9.1 Following tests shall be carried out:

- a) Rating test, including the fuel consumption test.

- b) Governing test (for engines with governor).
- c) No load and low speed test (for engines without governor).
- d) Starting test.
- e) Endurance test.
- f) Rating test after endurance test.
- g) Strip examination for checking of various components.
- h) Reassembly, starting test and no load running.

9.1.1 During testing, the routine servicing and minor adjustments as required by the manufacturer's instruction manual shall be carried out.

9.2 Rating Test — The engine shall be positively coupled (direct or by chain drive), preferably through a flexible coupling, to a suitable dynamometer. Before starting the test, the engine shall be allowed to warm up to stabilized temperature by gradually increasing the load in the manner recommended by the manufacturer. The test shall be carried out in the following manner, at the rated speed:

Load (percent)	100	110	75	50	25	0
Duration of fuel consumption test, min	10	10	10	10	10	10
Duration of rating test	7 h 30 min	30 min	10 min	10 min	10 min	10 min

Note 1 — Hundred percent or 'full load' denotes the state of the engine when it is developing the continuous rated brake power at the rated speed.

Note 2 — One hundred ten percent load test may be conducted during the 100 percent load test at any suitable time, so that the total time of 100 percent and 110 percent load tests is 8 hours.

Note 3 — Engine fitted with governor shall be adjusted to rated output at rated speed. No further governor adjustments shall be done for other loads. The output is to be calculated considering the torque and speed attained.

9.2.1 Following observations shall be made during the rating test and recorded:

- a) Ambient conditions, atmospheric pressure, inlet air temperature [see Note under 3 (b)], and relative humidity.

Note — Inlet air temperature shall be measured as in 3 (b), after the engine has reached stabilized temperature, and shall be checked once every two hours during the full-load run so as to obtain an average reading.

- b) Dynamometer load.
- c) Engine speed.
- d) Fuel consumption shall be measured by volume in litres per hour. Specific fuel consumption shall be expressed in grams per kilowatt hour. Duration of each reading of fuel consumption should be minimum 30 seconds. During the full-load run, at least four readings shall be taken at equal intervals. Readings may be taken if necessary during part-load runs also.

Note — When lubricating oil is mixed with petrol, the quantity of oil mixed shall be deducted from the total fuel consumed for determining the consumption value.

- e) Temperature of cooling water at the outlet of the engine (for water-cooled engine).
- f) Temperature of lubricating oil in the sump (wherever applicable). The reading shall be taken at the end of the full-load run.
- g) Lubricating oil pressure (for engine provided with forced lubrication). Reading shall be taken just at the beginning of full-load run and shall be repeated twice during the full-load run. This test may be omitted if suitable outlet for connecting a pressure gauge is not provided on the engine.

9.2.1.1 Observations at (f) and (g) are not applicable to two-stroke engines using petrol.

9.3 Governing Test — Applicable for engine fitted with governor.

9.3.1 When the engine, running at rated speed and developing rated output, is suddenly relieved of the load, the resulting speed changes shall be within the values given below:

Governing Class	Momentary Change Percent of Rated Speed, Max	Permanent Change Percent of Rated Speed, Max
1	12	6
2	15	10

For Class 1 governing, the resulting speed change for 20 percent step of rated load shall be 4 percent (Max) as momentary change percent of rated speed, and 3 percent (Max) as permanent change percent of rated speed.

9.4 No Load and Low Speed Test — Applicable for engine without governor. These tests shall be carried out on the engine without coupling it to the dynamometer.

9.4.1 When the engine is accelerated from an arbitrary low speed, it shall be able to run up to 120 percent of rated speed and maintain it for 10 seconds. The procedure shall be repeated 6 times at intervals of 10 seconds. No failure shall be observed.

9.4.2 The engine shall run steadily, for at least 10 minutes, at 50 percent of the rated speed.

9.5 Starting Test — This test shall be carried out on the engine without coupling it to the dynamometer. The engine shall be mounted at a convenient height for the operator conducting the test.

9.5.1 Engine designed for manual starting shall be capable of being started by hand. This test shall be conducted when the engine is cold (at room temperature) and also when it is hot, that is, immediately after the load test. The engine should be started three times in succession but before each starting, the engine should be brought to room temperature.

9.5.2 For the starting test, the attempt to start the engine shall be made using the normal procedure recommended by the manufacturer. The starting shall be deemed successful when the engine runs for 10 seconds. The number of attempts made to start the engine shall be recorded. If the engine fails to start within 10 minutes, the engine should be considered as having failed the starting test. Whenever possible, the reasons for failure to start shall be determined and stated in the test report.

9.5.3 In case of engine fitted with electric starter, the starter shall be able to start the engine for minimum 3 times in succession. The power source used for this test shall be as recommended by the manufacturer for normal use of the engine.

9.6 Endurance Test

9.6.1 The engine shall be subjected to an endurance test of 98 hours duration in non-stop cycles of 7 hours duration each, conforming to the following cycle pattern:

Load on Engine (Percent)	Duration (Hours)
100	2 (including warm up period)
75	2
100	2
50	1

Note 1 — During the cycle, the speed shall be maintained between 90 and 100 percent of rated speed. In case of two-stroke engine, the plugs may be cleaned according to the instructions given by the manufacturer.

Note 2 — If the engine needs to be stopped during any cycle for any minor attention, the running time of that cycle shall not be counted as part of the test and the cycle shall be recommenced.

9.6.2 Lubricating oil consumption — The test shall be carried out during the endurance test to determine the lubricating oil consumption in g/h. The consumption shall be measured by noting the amount of oil required to bring back the level in sump or oil tank to the initial level, over a definite period of engine operation. Before taking the reading, the temperature of the engine sump oil shall have reached within 5°C of the room temperature.

Note — The determination of lubricating oil consumption is not applicable to the two-stroke engine using petrol.

9.7 Rating Test After Endurance Test — Shall be carried out after the endurance test. The procedure outlined in 9.2 shall be adopted. The percentage increase in specific fuel consumption and decrease in power shall be as agreed to between the manufacturer and the purchaser.

9.8 Strip Examination — The engine shall be dismantled and dimensional and physical inspection shall be carried out for components checked during initial examination (see 8.1) to find out whether any undue wear has taken place (see Appendix B).

9.9 Reassembly — The engine shall be reassembled, adjusted and run for five minutes at no load to ensure that reassembly is properly done.

10. Marking

10.1 The engine shall be marked appropriately with the following:

- Manufacturer's name, trade-mark and number;
- Rated power; and
- Rated speed.

10.1.1 ISI Certification Marking — Details available with the Indian Standards Institution.

APPENDIX A

(Clause 2.2.4)

EXAMPLES OF AUXILIARIES WHICH MAY BE FITTED

Note — These lists are given for guidance only and are not necessarily complete.

List A *Essential, Dependent Auxiliaries* (see 2.2.1 and 2.2.3)

- 1 Engine-driven lubricating oil pressure pump
- 2 Engine-driven lubricating oil scavenge pump for dry sump engines
- 3 Engine-driven engine cooling water pump
- 4 Engine-driven radiator cooling fan
- 5 Engine-driven engine cooling fan for air-cooled engines
- 6 Engine-driven fuel feed pump
- 7 Engine-driven generator, air compressor or hydraulic pump when supplying power to items in List B
- 8 Engine-driven cylinder lubricating pump
- 9 Air cleaner or air silencer (normal or special)
- 10 Exhaust silencer (normal or special)

List B *Essential, Independent Auxiliaries* (see 2.2.2 and 2.2.3)

- 1 Separately-driven lubricating oil pressure pump
- 2 Separately-driven lubricating oil scavenge pump for dry sump engines
- 3 Separately-driven engine cooling water pump
- 4 Separately-driven radiator cooling fan
- 5 Separately-driven engine cooling fan for air-cooled engines
- 6 Separately-driven fuel feed pump
- 7 Separately-driven cylinder lubricating pump
- 8 Governing or control system using power from an external source

List C *Non-essential, Dependent Auxiliaries* (see 2.2.1 and 2.2.4)

- 1 Engine-driven starting air compressor
- 2 Engine-driven generator, air compressor or hydraulic pump when supplying power to items not in List B
- 3 Engine-driven fire pump
- 4 Engine-driven ventilation fan
- 5 Engine-driven fuel transfer pump

APPENDIX B

(Clause 9.8)

ACCEPTANCE STANDARDS FOR TESTS

B-1. Overload Test — During the overload test (110 percent load), the engine shall not fail as a result of overheating, nor should there be any undue noise or dark exhaust.

B-2. Fuel Consumption — For specific fuel consumption, measured at rated output and rated speed, 5 percent tolerance above that of declared specific fuel consumption shall be acceptable.

B-2.1 If the engine is being tested with reduction gear box (as an auxiliary), a value of up to 3 percent over and above the permissible limit mentioned in **B-2** shall be allowed.

B-3. Rating for Engine with Auxiliaries — If the engine is offered for test along with power-consuming auxiliaries, such as gear box, the corresponding values of the rated output and the specific fuel consumption shall be declared by the manufacturer.

B-4. Carburettor — During the entire test, the carburettor shall be free from any manufacturing defect affecting the smooth running of the engine. For engine fitted with governor, no adjustment should be necessary once the governor is set for rated output and rated speed at the beginning of the load test.

B-5. Ignition System — During the entire test, the ignition system shall be free from any manufacturing defect affecting the engine starting or running performance. However, cleaning or adjustment of spark plug and contact breaker shall be carried out as recommended by the manufacturer.

EXPLANATORY NOTE

This Institution having agreed to adopt, along with other standards organizations, the SI units based on ISO/R 1 000 'Rules for the use of units of the international system of units and a selection of the decimal multiples and sub-multiples of the SI units', issued by the International Organization for Standardization, all values in this standard have been given in SI units.

In this standard, following units have been used:

- a) Pressure — Kilonewtons per square metre (kN/m^2)
 $100 \text{ kN/m}^2 \approx 750 \text{ mmHg}$
- b) Power — Kilowatts (kW)
 $1 \text{ kW} \approx 1.36 \text{ metric horse power}$

Standard reference conditions, correction factors for power and specific fuel consumption given in this standard are in entire agreement with those given in ISO/DIS 3046 'Reciprocating internal combustion engines — Standard reference conditions and declarations of power, fuel consumption and lubricating oil consumption' issued by the International Organization for Standardization.

